Study of the Application of Knowledge Base through New Product Development in the System Integration Industry – Comparison of Case Studies Based on Different Product Newness

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Received 20 April 2013; Accepted 7 May 2013; Published 19 March 2014

Abstract

The system integration industry involves hundreds of enterprises. In this highly competitive environment, new product development becomes crucial to profitability and competitive advantage. New product development involves several activities, each involving different problems. Enterprises use Knowledge Base (KB) to identify effective solutions to the problems occurring at each stage. Producing system integration products involves both design and customization, and therefore each case is unique. Products at different stages of the development process involve different issues. Additionally there is different application from KB.

This study takes different degrees of product newness as a focus for examining both new and upgrade products as variable factor, as well as the issues and support involved in new product development. Six cases are used to analyze KB (Knowledge Base) application. The study shows that enterprises should seek different degrees of support from KB and suppliers when facing different technical and non-technical problems. Regarding technical issues, for really new products it is argument setting of KB application; for upgrade products it is argument setting of KB application. Regarding non-technical issues, for really new products these refer to planned applications of KB; for upgrade products these refer to planned applications of KB.

Keywords

System Integration Industry; New Product Development Process; Knowledge Base Application; Supplier Support; Product Newness; Technical Issues; Non-Technical

Introduction

To preserve enterprise profitability and competitive-ness new products must be introduced at a constant pace. If enterprises fail to research product innovation, leading to their products becoming out of date, innovators with sufficient ability will develop replacement products (Millett, 1990). New product development has gradually become a key concern of scholars. Knowledge base applies the intersection of new product development and support offered under procedure to and how about support, offering an advantage rare in existing research. This study thus examines another perspective: the new product development procedures of the information system integration industry, as well as the knowledge applied in each activity. In academia, the results of this study can offer more rigorous thinking, and msimultaneously provide offer a better reference to scholars. Enterprises can effectively use knowledge base in new product development, and can increase their competitive advantage to help them build up their competitive advantage in this area, and there is reference value on practice.

The research objectives are summarized as follows:

- Exploring the issues faced at different stages of NPD in the system integration industry.
- Exploring how to use knowledge base to solve

problems when facing different issues.

- Exploring the different issues involved at different stages of NPD when dealing with products with different degrees of newness.
- Exploring different knowledge base applications associated with different levels of product newness.

Literature Review

New Product Development Process

Extensive literature exists on product development. Searen (1984) and Trott (1998) reviewed the literature and categorized the NPD process into the following six models: "departmental-stage", "activity-stage", "decision-stage", "conversion process", "response" and "Network". Scholars differ according to their research objectives, and adopt different models in their research. The research on new product development recently has mostly focused on activity stage. This study considers the activity stage a key stage in new product development.

Ulrich & Eppinger (2007) proposed a six stage NPD process, including planning, concept development, systematic design, detailed design, testing and revision, and finally production. Wuang, Huang & Chuang (2009) divided new product mdevelopment into the five stages of intention to produce, design, prototype, test-manufacturing, full-scale manufacturing and production. Wuang, Huang, Yang & Lin (2010): New product development is divided into: planning of motion, product development, test-manufacture planning, full-scale production, and final marketing.

Summarizing the relevant literature reveals that the industries or targets studied are different, it is annotated that different. However, the literature agrees that new product development begins with market demand, customer demand, organizing new product operation and development, and finally launching new products on the market. New product development is designed to meet market goals, focus professional knowledge and technology from different department personnel, and deal with research and development through innovation, using various materials to create new products. Because of differences such as enterprise properties, organizational culture, nproduct type attitude, management tactics, managerial style, etc., enterprises frequently adopt different approaches to new product development. This study focuses on companies involved in system integration, whose businesses are focused on customer demand for information system functions, disposing, installing and testing software and hardware for essential systems, assisting in serving the needs of the intersection, and classifying new product development procedures:

- Customization demand collection stage
- Planning stage
- Product Development stage
- Installation and feedback stage

New Product Development Problems

New product development involves numerous problems, and is highly complex, with problems including: changes in market competition, customer demand, technology, government regulation, and so on (Song et al., 1998). Rosenau & Moranm (1993) identified three problems in product evolution: 1. Guaranteeing that the work progress of the product development group conforms with the expected activity time course; 2. Establishing and eventually abandoning products with weak potential; 3. Ensuring development is appropriately resourced.

Wuang et al. (2010), in their research on the product development procedures for mini notebook computers, proposed different stages of activity, each encountering different marketing and technological problems. During the market collection and design verification stages, the main problems are large-scale production and commercialization. Furthermore, during the planning stage, product design stage, sample testing, design testing, and test-manufacturing are the main technological problems.

As mentioned above, during every stage of new product development, both internal and external problems exist in enterprises, as well as specific problems that must be dealt with during new product development. After solving the problems involved in each stage of new product development, these problems can be divided into technological and non-technological problems. Technological problems mean developing the relevant problem with the products, comprising: software and hardware compatibility and installation, software and hardware installation, testing and proving, and on-the-spot installation problems.

Non-technical problems are those problems that do not directly influence product development and comprise: gathering information, communication with customers, estimating customer budget, and time

planning. This study thus provides (P1): Different problems exist at different stages of new product development.

Knowledge Base Application

Zack (1999) proposed that "knowledge is a strategic organizational resource", and sees knowledge as difficult to imitate, being by its nature impossible to quickly create because of the enormous mental and physical effort involved. Zack further proposed that because knowledge has these characteristics, enterprises obtain, merge, store, share and employ knowledge to gain a unique competitive advantage.

Knowledge is already widely considered the most important competitive resource of enterprises (Demsetz, 1991; Grant, 1996; Nonaka, Reinmoller, & Toyoama, 2001). Scholars have also observed that in the recent highly competitive environment, some corporate knowledge and technologies have brought firms transient competitive advantage, because companies cannot limit the flowability of knowledge, once knowledge is obtained by competitors, or more advanced competing knowledge emerges, companies will lose their competitive advantage (Cooper, 1994). Therefore, how enterprises use corporate knowledge base becomes a key source of their competitive advantage.

Corporate knowledge base is used to create a special database of knowledge management, including the collection, arrangement and drawing of relevant field knowledge. Knowledge comes from domain experts in the relevant fields, and solves required relevant field knowledge, including basic facts, rules and other relevant information.

How enterprises employ knowledge base to assist in new product development and to maintain and build competitive advantage is increasingly important. Companies therefore must develop procedures and environments conducive to knowledge creation, based on company knowledge, absorb new information and knowledge from external sources, then recombine and transform this external knowledge within the organization. Enterpirses can thus continuously improve their knowledge and create new knowledge which can be applied to enterprise operations, thus helping establish and maintain competitive advantage (Chou, 2005; Jayaram, Droge, & Vickery, 1999; Minbaeva, Pedersen, Bjorkman, Fey, & Park, 2003; Un & Cuervo-Cazurra, 2004).

An important question is how to employ knowledge base to help companies establish competitive advantage, as well as to explain and analyze further to enterprises, and scholars believe that new products result from knowledge creation, meaning firms can utilize invisible new knowledge to promote new product development. Enterprises can create new knowledge and also obtain value from better products. (Schulze & Hoegl, 2006) If new products can be developed from the new application of knowledge, then it should be possible to anticipate these new products. (Von Krogh & Grand, 2002) Therefore, knowledge base is employed to develop new products, and regardless of how tangible or invisible that knowledge is, it can help enterprises in cases where new products are made before a problem is solved, and can also increase the chances of new products succeeding when launched on the market.

Summarizing the literature reveals that the new product development factor is extremely influential, while regarding application knowledge base, it is only necessary to mention that adding knowledge applications to new product development can improve new products and effectively develop their performance. This study uses the practical application experience of enterprises to offer content focused on six types of knowledge base to assist in solving different problems. The six types of knowledge base comprise: Parameter set up, planning and consultation, test environment set up, problem solving and searching for functions. The assistance offered also differs to some extent with literary composition. This study thus proposes preliminary proposition two (P2): different knowledge base is employed when facing different problems.

Product Newness

Products able to fulfill unsatisfied market demand can be classified as innovations. From the market perspective, it is necessary to identify whether the new product has new functions that existing products lack. The following is a review of the literature on the above point regarding product newness.

The market demand view regards consumer demand as the direction. Ulrich & Eppinger (2007) addressed, Demand in meeting customer objectives for new products. Furthermore, Hisrich & Peters (1986) used the view of ' the influence on the consumption pattern ' as a basis for dividing new product innovation into three types: 1.Continuous Innovation 2.Dynamically Continuous Innovation 3.Discontinuous Innovation.

From the viewpoint of technology, Kotler (2009) divided new products into four types based on their

features: 1.original products, 2.improved products, 3.modified products, 4.new brands. Song & Weiss (1998) classified new products into two types: 1. Truly new products, 2. Incremental products. Song and Weiss also defined new products as follows: "The product is new to both manufacturers and the market, and the new components include new products, technologies, and market goals". Therefore, customers perceive the products as new whether the products are aspects of "new", can release the influence of 'new products' on the market.

Summarizing the above literature, each scholar notes the newness of the products for customers, products, competitor, market and enterprise, not making the products without forefront call it, as function, operating method, price, structure, etc. differ from the original, can call it the new products.

The case study IW company is a manufacturer of integrated systems, an industry that involves customization, meaning product newness is determined by company forecasts rather than the market. Facing products with different degrees of newness, the application knowledge base influences new product development. The knowledge base is used to divide the developed products into two types: new products and upgrades. New products: customer demand for a product exists, but products able to meet that demand do not yet exist. Adopt new equipment, software and hardware technology to develop new products. Upgrade products: Change the original project framework and use old equipment to develop products with new functions. The type and difficulty level of problems differs with product newness. This study thus proposes preliminary proposition three (P3): Product newness differs with new product development process. Facing different problems, product newness also differs with the knowledge base employed. Different problems use different applications from Knowledge base. This study thus proposes preliminary proposition four (P4): problems differ with degree of product newness, as well as KB application.

Methodology

The Conceptual Framework

Summarizing the literature review, this study arranged the conceptual framework as follows (Fig.1).

Preliminary Propositions

Based on the conceptual framework, this study makes the following preliminary propositions:

Preliminary proposition 1 (P1): Different issues are confronted at different stages of NPD.

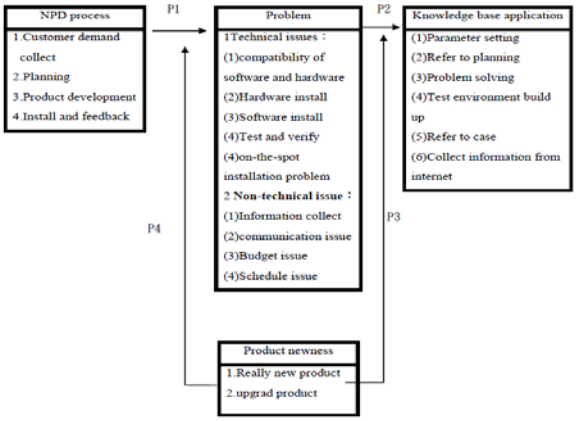

FIG. 1 THE CONCEPTUAL FRAMEWORK

Preliminary proposition 2(P2): Application knowledge base changes when facing different issues.

Preliminary proposition 3 (P3): The issues confronted change with product newness.

Preliminary proposition 4 (P4): The application of knowledge base differs with product newness and issues faced.

Research Design

The case study method is a tool for data collection and theory construction. This study applied the case study method mainly to analyze interpretations from individual participants. The numerous study participants had widely varying backgrounds and experience in the interaction between their companies and suppliers. The participation of the various participants was essential in this study.

Unstructured individual in-depth interviews are commonly applied in marketing research for producing oral histories, cultural interviews, life histories, for applying the critical incident technique, and for sequential interviews. This study applied the critical incident technique to clarify the practicalities involved in issues arising during NPD.

TABLE 1 CASES OF TWO DIFFERENT PRODUCT NEWNESS

Product newness	Product of case	name	position
Really new product	NPM serve	Mr. Lee	Accounting director
	NPM book reference	Mr. Wu	Book reference director
	Da Da	Mr. Lin	Project director
Upgrade product	Wizard	Ms. Wu	Information manager
	Z art museum	Ms. Chang	Project manager
	Da Da serve	Mr. Lin	Project director

Case Study

IW is a system integration enterprise in the industry.

Table 1 lists six cases. Two series products were selected, the first being a new product series, and the second and an upgrade server series. Owing to limitations of space, it is not possible to show the details of the six cases. The content of each case is based on a conceptual framework and shows specific issues and their applications from the knowledge base.

Detailed Proposition Development

This study is based on the results of case analysis, as listed in Table (2)

Results and Recommendations

Results

These research results indicated that the study focuses on both new and upgraded products as the variable factor, as well as the issues and applications from knowledge base to each other through the NPD process. Six case studies are used to analyze the issues involved in the application of knowledge base through the NPD process in the system integration industry. The results are presented as detailed propositions.

Recommendation

The research results indicated that when enterprises face different issues the knowledge base provides different potential solutions during the NPD process. The following are recommendations for truly new products and upgrade products.

For truly new products, during the customer demand collection stage, customers are often unfamiliar with each system integration product, and communicating with the customer therefore is often time-consuming and strenuous. Enterprises must be adequately prepared after gathering customer demands, and thus should plan according to customer application characteristics, and should confirm customer demand before proceeding to new product development. The reference data used in planning the increase in enterprise knowledge base should be constant, providing better planning for customer reference.

During the planning stage, engineers are consulted

TABLE 2 DETAILED PROPOSITION

Proposition 1	**At stages of NPD, confronting the issues differs.**
detailed propositions 1-1	The main issue of customer demand collection is communication issue.
detailed propositions 1-2	The main issue of planning is budget issue.
detailed propositions 1-3	The main issue of product development is test and verifies.
detailed propositions 1-4	The main issue of install and feedback is on-the-spot construction issue.
Proposition 2	**When facing different issues, the application from knowledge base differ.**
detailed propositions 2-1	The main application knowledge base when facing technical issue is parameter setting.
detailed propositions 2-1-1	The main application knowledge base when facing test and verify issue is testing environment build up.
detailed propositions 2-1-2	The main application knowledge base when facing on-the-spot construction issue is parameter setting.
detailed propositions2-2	The main application knowledge base when facing non-technical issue is reference to planning.
detailed propositions2-2-1	The main application knowledge base when facing communication issue is reference to planning
detailed propositions2-2-2	The main application knowledge base when facing budget issue is refers to case.
Proposition 3	**When product newness is different, confronting the issues differs as well.**
Detailed propositions 3-1	At thecustomer demand collect stage, the main issue of really new product is communication issue; the main issue of upgrade product is information collection issue.
Detailed propositions3-2	At the planning stage, the main issue of really new product is communication issue; the main issue of upgrade product is budget issue.
Detailed propositions3-3	At theproduct development stage, the main issue of really new product is test and verify; the main issue of upgrade product is test and verify issue.
Detailed propositions3-4	At theinstall and feedback stage, the main issue of really new product are hardware install and on-the-spot construction; the main issue of upgrade product is on-the-spot construction issue.
Proposition 4	**When product newness is different and facing different issues, the application from knowledge base differ as well.**
Detailed propositions4-1	When facing technical issue, the main application from knowledge base of really new product is parameter setting; upgrade product is parameter and on-the-spot construction
Detailed propositions4-1-1	When facing test and verify issue, the main application from knowledge base of really new product is test environment build up; upgrade product is test environment build up and refer to case.
Detailed propositions4-1-2	When facing on-the-spot construction issue, the main application from knowledge base of really new product is parameter setting; upgrade product is parameter setting.
Detailed propositions4-2	When facing non-technical issue, the main application from knowledge base of really new product is refer to planning; upgrade product is refer to planning.
Detailed propositions4-2-1	When facing communication issue, the main application from knowledge base of really new product is refer to planning; upgrade product is refer to planning.
Detailed propositions4-2-2	When facing budget issue, the main application from knowledge base of really new product is refer to case; upgrade product is refer to case.

regarding cases already implemented in enterprises, and the planning is divided into to two or three parts to reduce customer budget, and make customers more on the planning content, as well as flexible adjustment, customer funds, and the space available for adjustment by enterprises.

During the product development stage, the engineer must precisely complete work and testing, and must feedback all questions to the knowledge base, as well as increasing the knowledge base data. The questions must be clicked and analyzed individually. The application mode is also recorded, as the accumulation of experience via the knowledge base is an important company asset.

During the installation and feedback stage, the parameters and data must be adequately set up in the knowledge base, and on-the-spot construction problems can be solved. Proposed solution: The parameters were used to set up the project and should bring in constant renewal of the knowledge base, when the engineer meets the on-the-spot construction question, utilizes the parameter for set up, and immediately solves the problem.

For product upgrade, during the customer demand collection stage, the problems arise from insufficiencies in old customer server information, causing enterprises to help with upgrading customer apparatus, owing to the available information being insufficient to solve the problem. The engineer should collect more information from the network, and bring the collected data into the knowledge base, making it convenient for users to obtain and use, and enabling rapid problem solving.

During the planning stage, the engineer is consulted regarding cases already implemented by enterprises, and the planning is divided into two or three parts to reduce customer budget, thus increasing customer willingness to become involved in planning. Enterprises should consult their knowledge base, and implement new product development based on principles of flexible adjustment in response to demand, matching customer budget, and providing space for adjustment.

During product development engineers need to refer to cases from the enterprise knowledge base except needing knowledge base to support to test the environment set up, to solve the problems associated with upgrading products at the product development stage. Proposal: precisely carry out testing, engineer willing to plan further. Enterprises should consult their knowledge base and design new products based

feedback regarding the knowledge base all question, and increase knowledge base data. Let users pursue data inquiry and application in the future.

During the installation and feedback stage, the parameter sets up the data, must be adequate for the knowledge base, and can solve problems on-the-spot. Proposed solution: The parameter sets up the project and should constantly renew the knowledge base, when the engineer solves the on-the-spot construction problems, the parameter is used to immediately set up and solve the problem.

REFERENCES

Chou Shih-Wei 2005. Knowledge creation: absorptive capacity,organizationalmechanisms, and knowledge storage/retrieval capabilities. Journal of Information Science, 31, 453-465.

Cooper, Robert G., 1994. New products: The factors that drive success. International Marketing Review, 11, 60.

Demsetz, H. 1991. The theory of the firm revisited.Nwe York: Oxford UniversityPress.

Grant Robert M., 1996. Prospering in dynamically-competitive environment: Organizational capability as knowledge integration. Organization Science, 7, 375-387.

Hisrich, Robert D., & Peters, M.P. 1989. Entrepreneurship – Starting, developing, and managing a new enterprise. Boston: Irwin.

Jayanth Jayarama, Cornelia Droge, Shawnee K Vickery. 1999. The impact of human resource management practices on manafucturing performance. Journal of operations management, 18, 1-20.

Kotler, P. 2009. Marketing Management: Analysis, planning, implementation, and control, (13thed.). NY: Prentice Hall.

Martin, G.L., & Dakin, S.R. 1984. Management and Magic. California Management Review, 27, 125-136.

Millett, S.M. 1990. The Strategic Management of Technological R&D: An Ideal. International Journal of Technology Management, 5, 153-163.

Minbaeva, D., Pedersen, T., Bjorkman, I., Fey, C., & Park, H. 2003. MNC knowledge transfer, subsidiary absorptive capacity, and HRM. Journal of International Business Studies, 34, 586.

Nonaka, I., Reinmoller, P., &Toyoama, R. 2001. Integrated information technology systems for knowledge creation. New York: Oxford University Press.

Rosenau, Milton D., &Moran, John J., 1993. Managing the Development of New Products. NY: Van Nostrand Reinhold.

Saren, M.A. 1984. A Classification and Review of Models of The Intra-firm Innovation Process. R&D Management, 14, 11-24.

Schulze, A., &Hoegl, M. 2006. Knowledge Creation in New Product Development Projects. Journal of Management, 32, 210.

Song, X. Michael & Weiss Mitzi M. Montoya 1998. Critical development activities for really new versus incremental products. Journal of Product Innovation Management,15, 124-135.

Trott, P. 1998. Innovation management & new product development. London: Pitman Publishing, 141.

Ulrich, K.T., & Eppinger, S.D. 2007. Product Design and Development, (4thed.). McGraw-Hill.

Un, C. A., &Cuervo-Cazurra, Alvaro. 2004. Strategies for Knowledge Creation in Firms. British Journal of Management, 15, S27.

Von Krogh, G., & Grand, S. 2002. From economic theory toward a knowledge-based theory of the firm. In C. W.Choo& N. bontis (Eds.). The strategic management of intellectual capital and organizational knowledge: 163-183.

Wuang, Min-Sun, Huang, Rong-Hwa, Yang, Chang-Lin, & Lin, Mei-Ju. 2010. Key component supplier based on product newness during new product development-a case study of small Notebookl PC (Netbook PC) Manufacutrers in Taiwan, 2010 BAI International Conference on Business and Information, Kitadyushu, Japan, International Business Academics Consortium (i-BAC), 1-13.

Wuang, Min-Sun, Huang Rong-Hwa, & Chuang, K.C. 2009. Product development and distributor support activities in the semiconductor industry: a focus study – Case Study of Taiwan Notebook Manufacturers. 2009 BAI International Conference on Business and Information, Kuala Lumpur, MY.

Zack, M. 1999. Developing a knowledge Strategy. California Management Review, 41, 171-178.